An Urban Design Perspective To Classify Knowledge Precincts: A Typological Analysis Of Global Best Practices

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ABSTRACT

Purpose: *The paper seeks to investigate emerging knowledge precincts under the urban design lens in order to identify recurrent spatial patterns of urban forms and functions to gather an understanding of physical aspects that contribute to the creation of place quality.*

Scope: *This paper focuses on the physical design and layout of specific precincts. Although socio-economic and other factors come into play imparting the distinctiveness; this paper only focuses on the spatial dimensions.*

Method: *The research first develops a design typology framework through the lead of literature, and then utilizes it to identify recurrent elements in knowledge precinct design in order to develop taxonomy of patterns and layouts.*

Results: *The research reported in this paper provides preliminary insights into the various form and functional factors playing role in the design of knowledge precincts and evaluates the elements that contribute to the success of these urban interventions.*

Recommendations: *The paper recommends the use of particular design-based solutions in order to enhance the place making in knowledge precincts.*

Conclusions: *The study concludes that despite the locational, regulatory and other contextual differences, the underlying driving principle of providing place quality to people leads to the emergence of identifiable spatial patterns across the knowledge precincts.*

KEYWORDS

Knowledge precincts; Design typologies; Place making; Urban design; Global best practices

1. INTRODUCTION

Knowledge-based urban development (KBUD) has been recognized as a strategic approach for the overall sustainable growth and long-term competitiveness of several cities globally in last decades (Knight, 1995; Kunzmann, 2008; Yigitcanlar, 2010). This approach towards urban growth has led the development of specific policies supporting the creation of specialized precincts better defined as the knowledge milieus, that act as the spatial nexus of KBUD, i.e., knowledge precincts (KPs), taking over precedence in the urban development agendas of the cities racing up in global economic competition (Carrillo, 2010). KPs are developed as a mixed-use postmodern urban setting providing the environment of live-work-play-cyber within the same boundaries (Yigitcanlar et al., 2008a; Yigitcanlar & Dur, 2013). Though the social, economic and organizational layers play a significant role, but the success and viability of these precincts in the attraction and retainment of target talent group—i.e., knowledge workers also depends on the way they are conceptualized and designed aiming at place making to provide them quality of life (Pratt, 2000; Sheppard, 2002; Florida, 2005; Yigitcanlar et al., 2007). Hence place making is increasingly bestowed with a high level of significance by the policymakers of knowledge economies worldwide (Yigitcanlar et al., 2008; Yigitcanlar & Lonqqvist, 2013). Many cities like Singapore, Zaragoza and Eindhoven have been branding themselves on the basis of the vibrantly designed living environment in their emerging KPs on similar lines (Landry, 2000; Carrillo, 2004; Fernandez-Maldonando, 2012).

To achieve the objective of providing better place environment to the knowledge workers in KPs, it is essential to investigate them under the design lens as it plays a central role in characterizing and defining the place experience (Buttimer, 1980). One significant strand in the approach taken towards understanding the evolving design and development patterns in the field of urban design is to identify common patterns and classifying them in typologies (Carmona et al., 2010). Development pattern here refers specifically to the two-dimensional layout of an urban area in deliberate formations contrary to the spontaneous aggregations (Marshall, 2005). Defining the term typology, Marshall (2004) pointed out that typology is the system of recognition or classification of types. The analysis of growth form and working out typologies is of particular interest to the policy makers as this activity has tangential advantages attached to it and on the basis of current growth would help to determine the future to-be-optimized case (Kelbaugh, 1997; Marshall, 2005). The study of physical form is

also necessary as it affects the behavior of users, i.e., knowledge workers in this case. Hence analyzing it allows understanding the conditions for better place making in KPs.

This paper is a preliminary investigation into the identification of recurrent spatial typologies of KPs. The methodology adopted for the paper is based on spatial analysis of selected case studies, discussed in literature as successful or emerging KPs. The research takes an inductive approach, first considering the spatial characteristics of individual KPs taken as cases, and then comparing them in order to generalize different urban patterns. The selected cases, which include the few world-wide known and successful KPs, are: One North (Singapore), 22@bcn (Barcelona), Brainport (Eindhoven), Digital Milla (Zaragoza), Hsinchu Science Park (Taiwan) and Cambridge Science Park (UK). The approach for the paper is largely descriptive not prescriptive.

2. THEORETICAL BACKGROUND

2.1. Knowledge precincts

KPs–interchangeably termed as science and technology parks, research parks, industrial parks and innovations parks–refers to an area where knowledge-based activities agglomerate to attain the following two primary objectives: (i) To be a seedbed and enclave for knowledge and to play the role of incubators facilitating the dissemination of knowledge and innovation; (ii) Act as a catalyst for regional economic development that promotes economic growth of the area (Ku et al., 2005; Yigitcanlar, 2006). On the basis of the literature review and best practice case studies, few major common spatial attributes of KPs are identified as follows:

Presence of mixed land use: Most of these new developments have manifested the post-modern urban scene by adopting the mixed use environment as a tool to provide the live-work-learn-play in the same precinct, thus blurring the boundaries between various urban functions and activities, aiming at facilitation for the free flow of knowledge to every urban activity (Page & Phillips, 2003; Yigitcanlar et al., 2008).

Spatial clustering: KPs are planned in a way to allow agglomeration of activities with the common knowledge base (i.e., ICT, media, communications, biotech and others) in close proximity to each other. Thus forming knowledge based clusters or spatial zones. With the help of such clustering, firms benefit from the agglomeration of other knowledge-based industries and workers (Baptista, 1996; Yigitcanlar, 2010).

Transit-oriented development: One of the major characteristics of KPs is the centrality of its location, which is enhanced by providing it the best connectivity in terms of supporting infrastructure that makes it accessible, served and well connected at the regional and global level. Hence most of these KPs are seen developing alongside major infrastructural elements like highways, high-speed metros or the railway lines.

The above spatial characteristics are accompanied by the following defining characteristics of KPs. Managed by the collaboration between public, private and academic sectors, they comprise of knowledge and technology-based enterprises, knowledge workers and research and development units and academic institutions, though the types of R&D and sectors, that they are focused on, may vary. Also they aim to provide high-tech living facilities that promote creativity and diversity catering to a range of lifestyle choices and celebrate the experience of place (Yigitcanlar & Dur, 2013).

2.2. Place making: concept and attributes

A number of theoreticians have sought to identify the attributes that contribute towards better place making in generalized context. With the growing significance of place making as a critical factor for economic success of KPs, the following theoretical foundation based on providing better places stands relevant for the environment of KPss as well. Lynch (1981) indicated vitality, sense, fit, access and control as the five main performance dimensions of good urban design. Jacobs and Appleyard (1987) expressed more prescriptive framework for physical and spatial forms pointing out the major characteristics as livability, identity and control, accessibility, meaning, community and public life, urban self-reliance and an environment for all. A specialized approach for producing more democratic and enriching environments should be adopted for creating responsive places (Bentley et al., 1985). In order to investigate the spaces holistically, Lefebvre and Nicholson Smith (1991) proposed a triad-spatial analytic framework to explore places as—conceived, perceived and lived. The defining attributes for an environment that caters to diversity and a range of users with multiple requirements arising from this approach are permeability, variety (vitality, proximity and concentration), legibility and robustness (McGlynn & Murrain, 1994). Assigning greater value to place, the government publication of DETR/CABE (2000) mentioned seven major attributes defining place making for any environment as character (identity of its own), continuity and enclosure (well distinguished public and private spaces), quality of public

realm (enhancing social interaction), ease of movement (accessibility), legibility (clear image and meaning), adaptability (flexible spaces), and diversity (variety and interest). In order to create a place for knowledge workers in the contemporary KPs, it is inevitable to consider its democratic and flexible aspects to cater the needs generated by diversity and the ever changing globalized forces.

3. CONCEPTUAL AND METHODOLOGICAL FOUNDATIONS

3.1. Methodology

Typologies are seen as a formalized and systematized tool of learning from experience and developing understanding by extracting some identical features that relate the development patterns in places lying in different contexts, thus leading to the generalization of phenomenon (Kelbaugh, 2002; Marshall, 2005). The variation in the variables or the attributes considered for the purpose of identifying the different typologies depends largely on the objective behind. As the knowledge generation depends significantly upon the talent, i.e., knowledge worker communities here, urban phenomenon of place making has been given due significance in the development of KPs (Yigitcanlar et al., 2007; Florida, 2012). Here, our objective is to analyze the spatial form taken by the knowledge activities and the resultant spatial approach towards place making for people and firms taking shape there.

The methodology adopted here takes an inductive approach initiating with the individual analysis of the urban pattern of each KP. After establishing the base by identification of the common design attributes, that define these precincts, the next step would then involve the classification of these precincts and arriving at typologies. Thus our approach will be composite that will explore the bundling of elements, dimensions and characteristics to attain the abovementioned purpose. It should be noted that KPs are included as cases are those that are deliberately designed and not the organic agglomerations. Few cases are fully developed and others in the developing phase, so where applicable we shall discuss the case on the basis of its projected growth pattern, thus acknowledging the process as a part of place making.

4. EMPIRICAL STUDY

The study, majorly concentrated on the spatial dimension, is undertaken under the broad head of the two basic foundational elements of spatial development—form and function.

Following lead from the literature, the overarching framework investigating form and function is further broken into sub-heads considering the idea of place making at the core (Table 1). The criterion to explore functional aspects depends on the attributes of: (i) Legibility—i.e., image and meaning attached with the particular precincts, and; (ii) Continuity—relationship between land uses and activities. The 'form' has been investigated under the criterion of development pattern to explore the following spatial attributes: (i) Permeability—interconnectivity and flow in design (ii) Public realm—centrality and location of social activities; and (iii) Character—attribution of authenticity and variety in design.

4.1. Function

Legibility: The branding is seen as the promotion of desired set of values and image that attaches a meaning to the development (Zenker, 2011). Thus, legibility is interpreted through this image or branding of the development. In physical terms, one of the aspects it affects is the dominant land use. Few KPs have projected their image as high-tech innovation clusters which gets expressed in their dominant industrial use (i.e., 22@bcn and Hsinchu Science Park) and others have more of research and development sector (i.e., Cambridge Science Park). Few others that have been branding themselves as talent hub or experimental districts show a significant presence of public and social realm (i.e., One North, Digital Milla).

Continuity: The extent to which the boundaries between the functions and activities are blurred determines how vibrant and well used a place is going to be (Carmona, 2003). Though KPss develop as a mixed-use development largely, but depending on the image and meaning attached to each settlement, the degree of blurred boundaries and the prominence of the uses or activities may vary across the KPss. This gets manifested as the presence of mixed uses as zoned or as interweaved. The former refers to places with specialized zones or sectors for each use, physically separated either by a road or other element (i.e., Hsinchu Science Park, Brainport). The latter types are those that have highly interweaved mixed uses which are present in the same building or as a continuous sector with quite blurred boundaries between activities (i.e., Fusionpolis in One North and mixed use developments along central path, Paseo Del Agua, in Digital Milla, Zaragoza respectively).

4.2. Form

Permeability: This will address the attributes of connectivity and flow. The layouts of KPs are aimed at promoting the interconnectivity to facilitate the free flow of knowledge giving rise to permeable urban pattern. This gets manifested in the form of interconnections all through the site either in the form of grids or other spatial forms of interconnected layouts. KPs differ in the degree of permeability. In One North (Singapore), proposals are to pedestrianize even the setbacks of the building parcels to promote the permeability. Cambridge Science Park (UK) is similarly developed as a highly pedestrian and cycle-oriented place. Additionally, the permeability is also expressed in the form of visual connectivity that is emphasized by the use of continuous landscape or opening vistas (i.e., Digital Milla, Zaragoza).

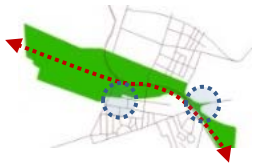
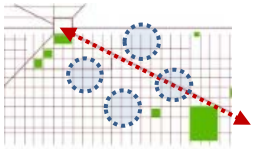
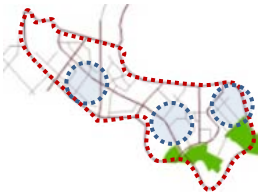
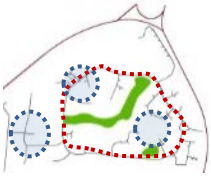
Public realm: The public realm—to promote face-to-face encounters and collisions—is aimed at, what is better known as, unplanned collaborations between not only people, but also the firms (Yigitcanlar et al., 2008). This is executed physically by providing the informal relaxing environment which acts as the catalyst in flourishing the creativity, flow of knowledge and accommodating the diversity. The development of public realm has been given the central importance in all the precincts but manifestation of the principle varies in terms of its incorporation in the layouts. It is observed that assigned central significance in KPs formed precincts as ‘talent’ hubs (i.e., One North, Singapore and Digital Milla, Zaragoza).

Character: This constitutes the place making attributes of authenticity and variety. The integration of arts and technology in design in the form of heritage, landmarks or use of high-tech design elements to produce innovation-enabling experimental environments is considered as a tool for place making. This actively involves and attaches the users giving them a sense of identity and control enhancing their learning in the process (Carmona, 2003). As it is seen in the example of Brainport, Eindhoven where technological design acts as the main connecting factor by its manifestation all along the linear axis at various places in the form of landmarks, which are mostly the old industrial buildings converted as heritage buildings (Fernandez-Maldonado, 2012). Digital Milla (Zaragoza) exemplifies this extensively by incorporating many such technological and experimental design elements in its digital public realm like the memory paving, digital water walls, bus stops etc. that define its designed environment based on innovation (Yigitcanlar et al., 2008).

Table 1. Form and functional analysis of contemporary KPs

Criterion	*Case 1*	*Case 2*	*Case 3*	*Case 4*	*Case 5*	*Case 6*
	Type 1				***Type 2***	
Example	One North Singapore	Digital Milla *(Zaragoza)*	22@bcn *(Barcelona)*	Brainport *(Eindhoven)*	Hsinchu Science Park *(Taiwan)*	Cambridge Science Park *(UK)*
			Function			
Legibility and continuity						
Branding (image)	Global talent hub	Open source digital city	Innovation district	Light city	High-tech Industrial park	High-tech R&D cluster
Location	Centre of the city	Centre of the city	Centre of the city	Centre of the city	Regional	Regional
Functional use (major)	Work-Live-Learn-Play	Work-Live-Learn-Play	Work-Live-Learn	Work- Live-Learn- Play	Work- Live-Learn	Work-Live-Learn
Land use	Interweaved mixed-use	Interweaved mixed-use majorly green areas	Zoned mixed-use, majorly industrial	Zoned mixed-use, majorly industrial	Zoned mixed-use, majorly industrial and R&D	Zoned mixed-use, majorly R&D
Industrial clustering	Biotech ICT Media	ICT Biotech Media Design	Media ICT Medtech Energy	Design ICT Energy	ICT Biotech Energy R&D	ICT Biotech
			Form			
Permeability and public realm						
Visual flow/ connectivity	Use of landscape	Use of pathways and park	Use of diagonal boulevard	*N/A*	*N/A*	*N/A*
Connectivity (pedestrian)	High (pedestrian-oriented)	High (pedestrian-oriented)	Medium	Medium	Medium	High (pedestrian-oriented)
Open spaces (public use)	Continuous	Continuous	As a sector	As a sector	Dispersed	Dispersed
Character						
Integration of heritage	Yes (e.g., Colonial bungalows)	Yes (e.g., El Portillo station)	Yes (e.g., City core industries)	Yes, (e.g., Strijp-S / Witte dam)	*N/A*	*N/A*
Arts and interactive technology in design	Yes, (e.g., Vista Xchange)	Yes (e.g., digital public realm)	*N/A*	Yes (e.g., light shows and events)	*N/A*	*N/A*

Table 2. Spatial patterns of the contemporary KPs

Case		*Examples*	*Indicative layout*	*Development pattern*	*Central spine*
Case 1	T Y P E 1	One North *(Singapore)*		Bent grid with central spine	Yes, as public realm
Case 2		Digital Milla *(Zaragoza)*		Hybrid with central spine	Yes, as public realm
Case 3		22@bcn *(Barcelona)*		Regular grids	Yes, as boulevard
Case 4		Brainport *(Eindhoven)*		Radial with industrial core	N/A
Case 5	T Y P E 2	Hsinchu Science Park *(Taiwan)*		Loop and grid	N/A
Case 6		Cambridge Science Park *(UK)*		Loop and cul-de-sacs	N/A

Legend

5. RESULTS

Following the analysis, two major typologies emerge on the basis of the exploration of spatial development pattern and the centrality of place making in the layout (Table 2).

5.1. Type 1: Site centrality-oriented development with central connecting spine

The first two cases, i.e., One North (Singapore) and Digital Milla (Zaragoza) can be classified together under Type 1 where the development is centred along the central spine that acts as the public realm. This spine can be in the form of a landscape flowing continuously between two endpoints (i.e., One North Park in Singapore) or as a central public spine with a range of mixed-use activities (i.e., Paseo Del Agua and aligned developments in Digital Milla). Thus, this can be regarded as one of the physical approaches for bringing the people and place making at the center of the development. Place making here is further supported by presence of lots of inter-connectivity, permeability and the pedestrian-oriented environment.

5.2. Type 2: Development as loop and dispersed sectors with no central spine

In the last two cases, it is observed that few industry-centered developments have grown as enclosures or loop based formations. The cases falling under this category are Hsinchu Science Park (Taiwan) and Cambridge Science Park (UK). These are the environments, which have firms and the R&D sector at the heart of their development. Though a continuous central public spine is absent, place making for knowledge workers is undertaken by developing public activities dispersed all along the site (i.e., Hsinchu Science Park) or by development of pedestrian and cycle-friendly environment (i.e., Cambridge Science Park).

However, case 3 and case 4 present exceptions here. Case 3, i.e., 22@bcn, Barcelona has a central spine based layout. But it is an industry-centered development as evident by its major functional uses. The central spine is in the form of the radiating diagonal boulevard that does not act functionally as public spine. Here the boulevard acts as the anchor and emphasizes the visual flow to open vistas. Public activities are concentrated in a sector. Case 4, i.e., Crossroads, Copenhagen has got initially developed radially with industries at the core and public spine is not manifested physically in the center, but still displays the inclusion of an effective place making. This has been done in this case by:

- Concentrating the public activities in sectors (i.e., Landscape and Leisurescape), thus giving them the scale required to organize large-scale international level events.

- Superimposition of cultural and social layer over the physical layer further strengthens the idea of interplay required between various layers for place making.
- Use of innovative experimental initiatives such as Light-S which is meant to communicate role of public lighting and latest innovations to the people thus disseminating the knowledge.
- Integration of heritage layers (i.e., Witte Dam and Strijp-S) to create interest and strengthen the place-identity.
- Use of landmarks like ‘Light Tower’ and ‘Clock Building’.

Thus it is evident that place making for the knowledge workers in the contemporary KPs is a phenomenon which portrays itself as the superimposition of various simultaneous layers. In conjunction with the spatial layer, other layers such as social and cultural layers act as an equal contributor and a strong tool for encouraging place making in KPs.

5. DISCUSSION AND CONCLUSION

The study here reveals that KPss considered as cases display different patterns, which stay commonly informed by underlying principles towards place making for knowledge workers. The types have been identified on the basis of design and development approach. Few cases like One North and Digital Milla are seen exhibiting the pattern being centered on the public and social aspects such as development of center spine as landscape and mixed-use social activities. In other industry-centered cases like Hsinchu Science Park and Cambridge Science Park, place making has been attained through pedestrianizing the environment and distributing the public realm in sectors over the whole site. Few cases like 22@bcn and Crossroads display an intermediary urban development pattern. Despite the basic economic, social, organizational, spatial and socio-cultural variations based contextual differences in each KPs, it is observed that certain features and attributes can be identified occurring commonly across the contemporary KPs. These involve the underlying principles of permeability, diversity, character, variety, authenticity, centrality of public realm, quality of life and place to create better place-based environment for people and firms both. Such holistic approach aims towards the strengthening of the fundamental pillars of knowledge-based urban development that stands on economic, socio-cultural, enviro-spatial and organizational development of society (Yigitcanlar, 2010, 2014).

The study also concludes that place making in the KPs is influenced via its form and location of functions, but there cannot be a single unanimously accepted spatial development pattern. The development pattern of each site will vary according to the context and conditions. Different contexts will shape and yield different forms and patterns individually and each case will have its own individual characteristics that distinguish it from others.

Further research directions would look into a wider perspective towards typological analysis by considering other attributes to include the perceived and lived space layer like accessibility, usage and the attributes related to urban fabric like scale, density, built form and so on in order to adopt a more holistic approach towards understanding conditions that help in place making. Additionally, innovation and knowledge spaces can vary at a wide scale from as small as designed innovation building to as large as the cities like Silicon Valley and similar others, which clustered as a spontaneous aggregation. In this paper, we have kept ourselves concentrated to the deliberately conceived, planned and designed district or precinct level development, i.e., KPs. Further research work needs to explore the organically developed agglomerations, such as Silicon Valley, of knowledge as well.

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